Wetlands 101: An Introduction to Wetlands Science

Virginia Science SOLs

6.7d, 6.9, LS.4b, LS.7, LS.8, LS.10c, LS.11, LS.12

Key Concepts

wetlands classification, benefits/value of wetlands to people, wildlife and water quality, predominant (wetland) plant species, physical adaptations, wetland soil characteristics and wetlands management

Vocabulary

wetland, detritus, hydrology, hydric soil, mottling, hydrophytic plants, estuarine, palustrine, emergent, marsh and wet meadow

Setting

classroom

Learning Objectives

Students will:

1. understand that wetlands are defined by the presence of water, specialized soils and hydrophytic plants.
2. be able to identify the ecological functions and values of wetlands.

Background Information

What is a Wetland?

Wetlands are transition zones between open water and upland areas. Typically, they are covered by water or have waterlogged soils for long periods of time. Plants growing in wetlands are capable of living in saturated soil conditions for at least part of the growing season. Wetlands such as swamps and marshes are often obvious, but some wetlands are not easily recognized, often because they are dry during part of the year or "they just don't look very wet" from the roadside.

Some of these wetland types include, but are not limited to, bottomland forests, pocosins, pine savannahs, northern bogs, wet meadows, prairie potholes, and wet tundra.

Why are Wetlands Important?

Wetlands provide many ecological, economic, and recreational benefits such as food and shelter for fish and wildlife; flood protection; shoreline erosion control; natural products for human use; water quality improvement; and opportunities for recreation, education, and research.

How do wetlands support many species?

Wetlands produce great volumes of food as leaves and stems break down in the water; this enriched material is called detritus. **Detritus** is food for insects, shellfish, and small fish, and it provides nutrients for wetlands plants and algae. Predatory fish such as striped bass, as well as mammals, reptiles, and amphibians, eat aquatic invertebrates and small fish.

Wetlands are vital to the survival of various animals and plants, including threatened and endangered species like the wood stork, Florida panther, and whooping crane. The U.S. Fish and Wildlife Service

estimates that up to 43% of the threatened and endangered species rely directly or indirectly on wetlands for their survival. For many other species, such as the wood duck, muskrat, or red winged black bird wetlands are primary habitats. Other wildlife species visit wetlands on a daily or seasonal basis to find food, water or cover.

Why are wetlands important to people?

Because wetlands are so productive and greatly influence the flow and quality of water, they are vital to people as well. Wetlands furnish natural products, including fish, timber, wild rice, and furs. In the Southeast for example, 96% of the commercial catch and over 50% of the recreational harvest of fish and shellfish depend on the estuary-coastal wetlands system. Waterfowl hunters spend over $600 million annually in pursuit of wetlands-dependent birds. Wetlands provide opportunities for popular activities such as hiking, fishing, and boating. An estimated 50 million people spend approximately $10 billion each year observing and photographing wetlands-dependent birds.

Wetlands often function like natural sponges, storing water (floodwater, or surface water that collects in isolated depressions) and slowly releasing it. Trees and other wetland vegetation help slow floodwaters. This combined action, storage and slowing, can lower flood heights and reduce the erosive potential of storms.

Wetlands help improve water quality, including that of drinking water, by intercepting surface runoff and removing or retaining nutrients, processing organic wastes, and reducing sediment before it reaches open water.

How do scientists distinguish a wetland?

Wetland scientists look at three criteria to determine if an area is a wetland—the **hydrology** of the site (patterns of water movement) and the presence of **hydric** (periodically saturated) **soils** and **hydrophytic plants** that are adapted to wet conditions. Wetlands are protected and are indicated on a map (delineated) before development is permitted.

Ten Things to Know about a Wetland

1. It doesn't have to look wet or be wet, to be a wetland.
2. There are many types of "wetlands."
3. Wetlands are important part of the food web of an ecosystem.
4. They are nurseries for many species.
5. Wetlands help protect water quality and quantity
6. They buffer shorelines against the impacts of storms.
7. They reduce the likelihood of flood damage to crops in agricultural areas
8. They help control the rate and volume of runoff in urban areas too.
9. They are noisy at night.
10. Wetlands are protected by laws.

1. Hydrology

Hydrology is easy to identify if the area has standing water. If the land does not, other signs such as damp or wet soils, or water pooling in dug holes can help clue one in to wet areas. Water marks, or stains from high water levels, are often visible on trunks of trees. Trees that stand for periods of time in saturated conditions often develop swollen bases. You can also look for sediment deposits or debris that looks as if it has been washed against obstacles and deposited by flooding water. Finally, the position in a landscape can also help you determine if an area is flooded at times.

2. Soils

Wet or hydric soil indicators can be observed in the field by digging a small pit to a depth of about 50 cm or 6 x 6 inch square and observing the soil

horizon. Due to decreased oxygen, respiration of roots and decomposition of plant matter are also reduced. This often leads to an accumulation of organic matter, which appears as a thick dark layer at the soil surface. Spots or blotches of different color interspersed with a dominant color is known as mottling and is another indicator of "reduced" conditions when it occurs in the upper soil horizons. The grayish, greenish or bluish hues indicate wet soil conditions.

3. Plants

Scientist use plants (vegetation) as the basis to describe and compare ecological communities. Plants are a critical component to the energy flow of the community – they provide food and habitat. Although animals are very important in natural communities, they are often highly mobile, difficult to document, and can be found in different ecological settings. On the other hand, the plants that form the vegetation of a site are essentially immobile, are easy to measure in a variety of ways, and typically reflect, both individually and as an assemblage, the specific conditions of the site.

The vegetation on a site can provide clues to the ecological processes of occurring there. Some plants are found in a limited range of soil moisture conditions, while others have a wider tolerance and can live in a variety of places. Common wetland plants include cattail, wild rice, bulrush, jewelweed, duckweed and water hyacinth. Most of the obvious wetland plant adaptations relate to capturing and storing oxygen.

While the boundaries between vegetation types may be distinct in some places, more often the boundaries are less distinct. Wetlands themselves are not separate units within an environment. They are interconnected to all the stream, rivers, ponds, groundwater, seeps and springs within the watershed and the habitat they provide is part of a larger corridor.

4. Animals

Wetlands' high biological activity level attracts more life. A myriad of animals utilize wetlands for food, shelter, spawning, nesting and hunting. Eighty percent of all breeding bird populations in the U.S. rely on wetlands as some point in their life cycle. Two examples of animal adaptations to wetland conditions are long legs and beaks of wading birds such as herons and storks and the moisture-retaining skin of amphibians like frogs and salamanders.

5. Virginia Wetlands

The largest portion of the wetlands in the Chesapeake Bay watershed are in the state of Virginia, 40%, compared to the next largest amount of 28% in the state of Maryland. More than one million acres of tidal (or estuarine) and non-tidal wetlands are protected by the Virginia Department of Environmental Quality. Virginia's coastal wetlands, particularly those in the York River watershed, are considered by scientists to be particularly vulnerable to sea level rise.

Eighty-six percent of the wetlands in the entire Chesapeake Bay watershed are non-tidal. Wetlands are further distinguished by their predominant vegetation. **Emergent** wetlands are made up of grasses, sedges and other leafy, non-woody plants. They are often called **marshes** or **wet meadows**. Shrub wetlands such as are characterized by low to medium height woody plants and forested wetlands are dominated by trees. Sixty-eight percent of the wetlands in the Chesapeake Bay watershed are forested. An exceptional diversity of wetlands is found across the Virginia landscape. Swamps, tidal marshes, wet meadows, bogs, pocosins and sinkhole wetlands are some of the many types found here.

Background, continued

In the Coastal Plain, wetlands are predominantly tidal marshes and tidal forests. In the Piedmont region, isolated or stream-side freshwater forests are the dominant wetland type. In the Blue Ridge Mountains, Valley and Ridge, and Appalachian Plateau, most wetland forests or marshes are associated with streams. Riparian wetlands found next to rivers and lakes and those isolated from any surface watercourse are termed, **Palustrine**.

Procedure

Divide the class into 5 research teams (that can continue as small groups for the field day): hydrology, soils, plants, animals and Virginia wetlands. Each group member will research the topic so they can assist with field research. Prior to the field day, each team will give an overview (briefing) of their subject to the rest of the class.

1. Hydrologists will research topography and flood plains of the site. Using maps of the area, they will look at the "lay of the land", identify creeks and streams, and predict where water is coming from and where it will flow.

2. Soil scientists will research soil types using soil maps of the area (http://websoilsurvey.nrcs.usda.gov/app/) and become familiar with wetland soil colors. The group should prepare their won wetlands soil color chart from Project WET "Wetland Soils in Living Color" lesson.

3. Botantists will research the list of plants of the area, understanding which have wide moisture tolerances and which need wet conditions to thrive. http://www.deq.state.va.us/export/sites/default/wetlands/pdf/restoringvawetlandstoolkit.pdf

4. Wildlife biologists will research the list of animals known to frequent the area including their diet and habits. (See Bird Field Guide_MWEE.pdf and wildlife list.)

5. Virginia wetlands experts should review the background information and research the websites listed in the resources section of this lesson. During the field day, the Virginia wetlands team will complete the First Impressions activity.

6. While in the process of preparing their report for the rest of the class, each small group should identify investigative questions they may be able to answer during the field day. Those questions should be shared along with the rest of the information. ***Suggestions for any modifications to the field day stations (that may be needed to accommodate these questions) should be made well in advance.***

Using the information collected before and after the field day, students can make inferences and develop hypotheses for further study. The class should also try to reach consensus on the value of this particular wetlands.

Assessment

In addition to a quiz on related vocabulary and key concepts, students can be evaluated on the clarity and thoroughness of their group report and their demonstrated understanding of the scientific process as it relates to field research. Participation in group discussion and overall enthusiasm should also be taken into consideration.

Resources

Virginia Department of Environmental Quality – http://www.deq.state.va.us/wetlands/volrestor.html

Chesapeake Bay Program – www.chesapeakebay.net

Virginia Department of Conservation and Recreation
http://www.dcr.virginia.gov/natural_heritage/ncintro.shtml.
http://www.dcr.virginia.gov/natural_heritage/ncPI.shtml

Environmental Protection Agency – http://epa.gov/owow/wetlands/

Virginia Institute of Marine Science – http://www.vims.edu

National Wetlands Inventory – http://www.nwi.fws.gov

Environmental Concern – www.wetland.org

Wetlands Watch – www.wetlandswatch.org

Invasive fact sheet – http://www.dcr.virginia.gov/natural_heritage/factsheets.shtml#native

Mistaken Identity? Invasive Plants and their Native Look-alikes: An Identification Guide for the Mid-Atlantic
This publication is a full-color, 62-page booklet. Targeted at land managers, gardeners, conservationists, and all others interested in plants, this booklet covers over 20 invasive species and their confusingly similar native look-alikes.
http://www.nj.nrcs.usda.gov/documents/Mistaken_Identity.pdf